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(54) Animal feeding apparatus

(57) An animal feeding apparatus having a first holding area (22) for the animals prior to feeding, a simultaneous weighing and feeding means (28), the feeding means being capable of dispensing feed according to the weight of the animal, and a second holding area (24) for the animal following feeding. The simultaneous weighing and feeding means may be a carousel (28) capable of carrying more than one animal, the carousel having an entrance (32) a means for weighing the animals on the carousel, means for dispensing feed (54) according to the animal's weight, a rotary means to rotate the animals during feeding such that they have sufficient time to feed before they reach an exit where they may alight from the carousel.

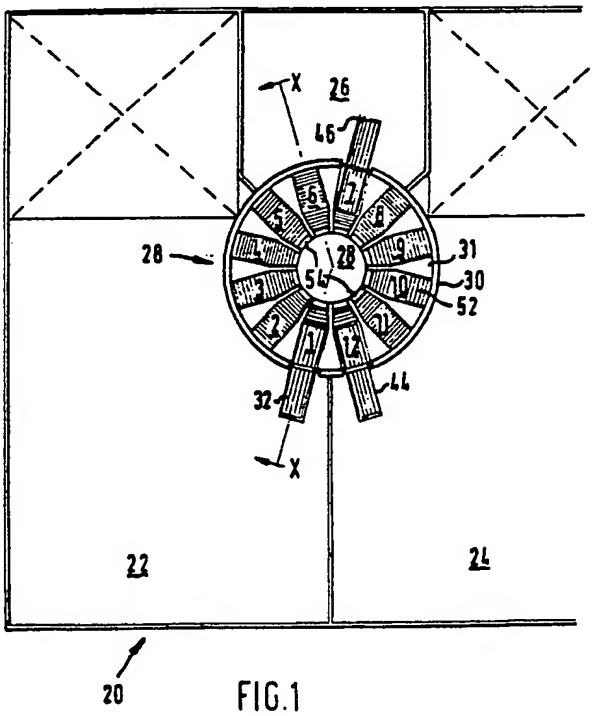

FIG.1

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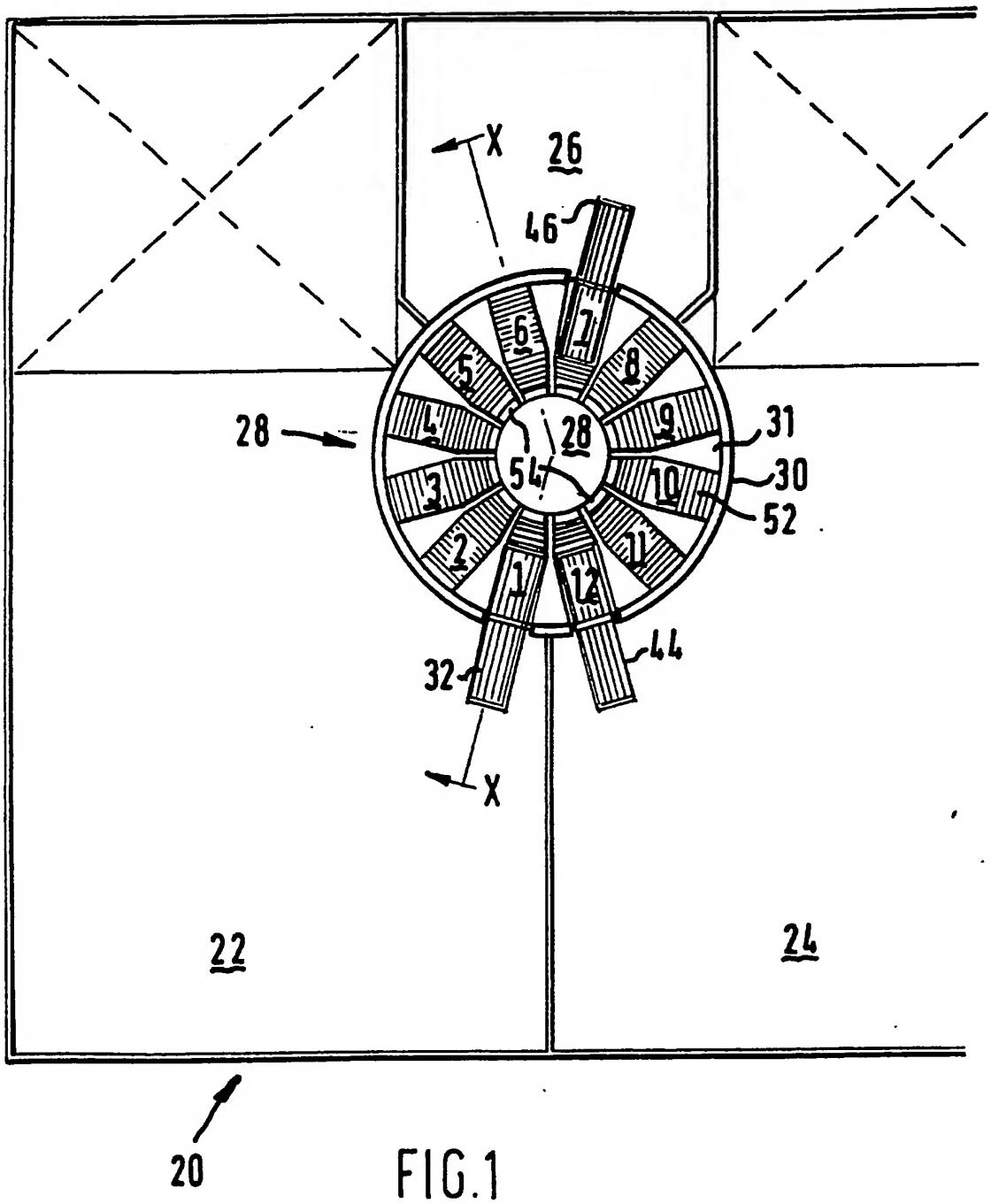
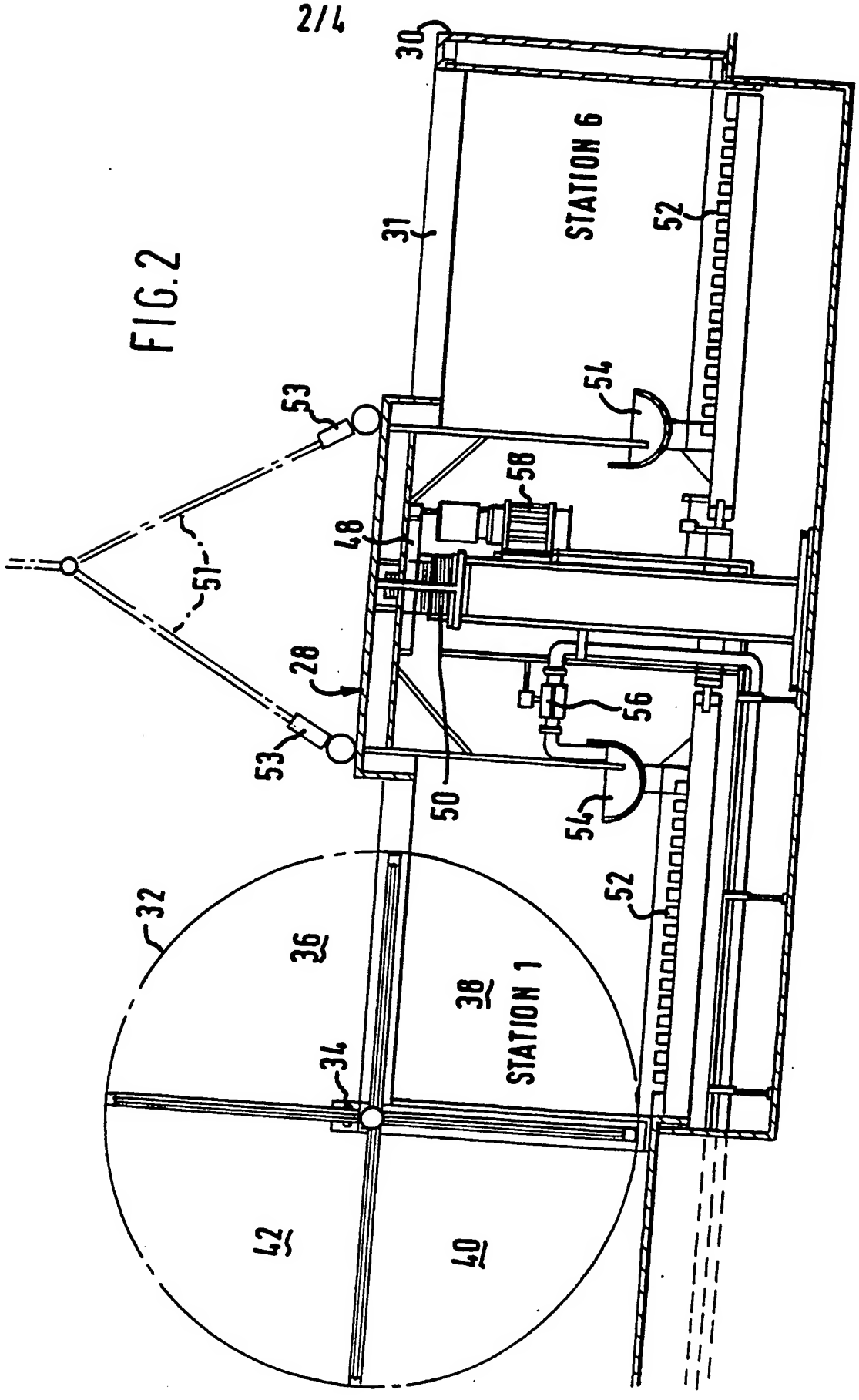


FIG.1

FIG.2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STATION 6
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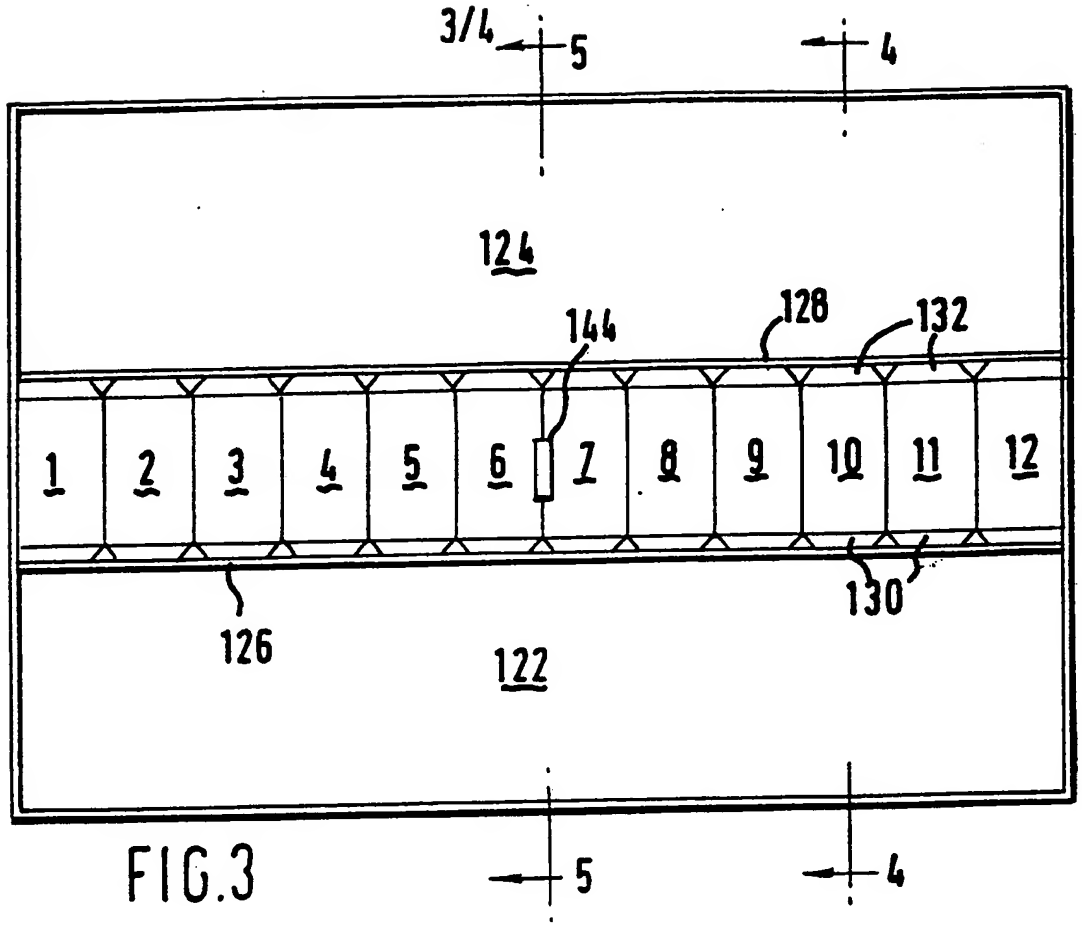


FIG.3

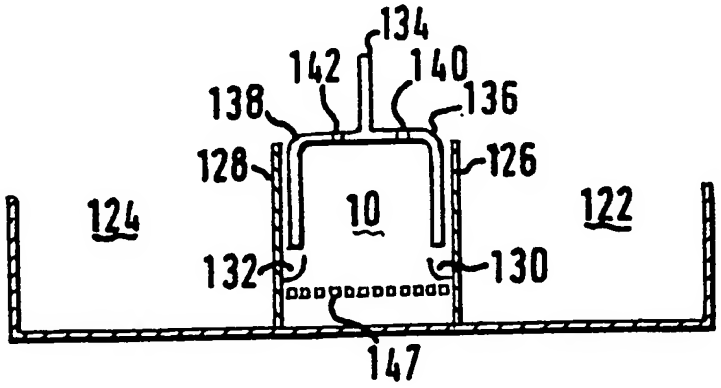


FIG 4

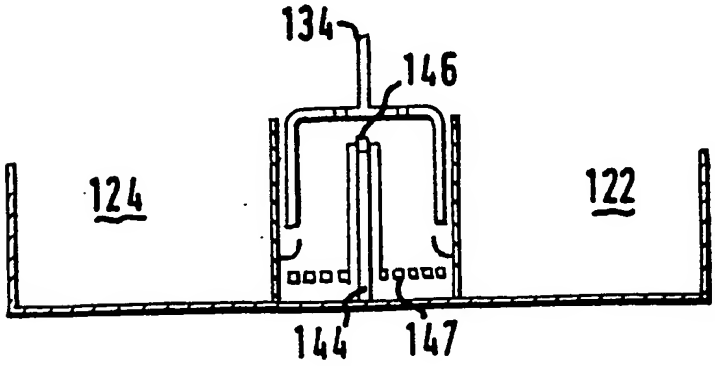
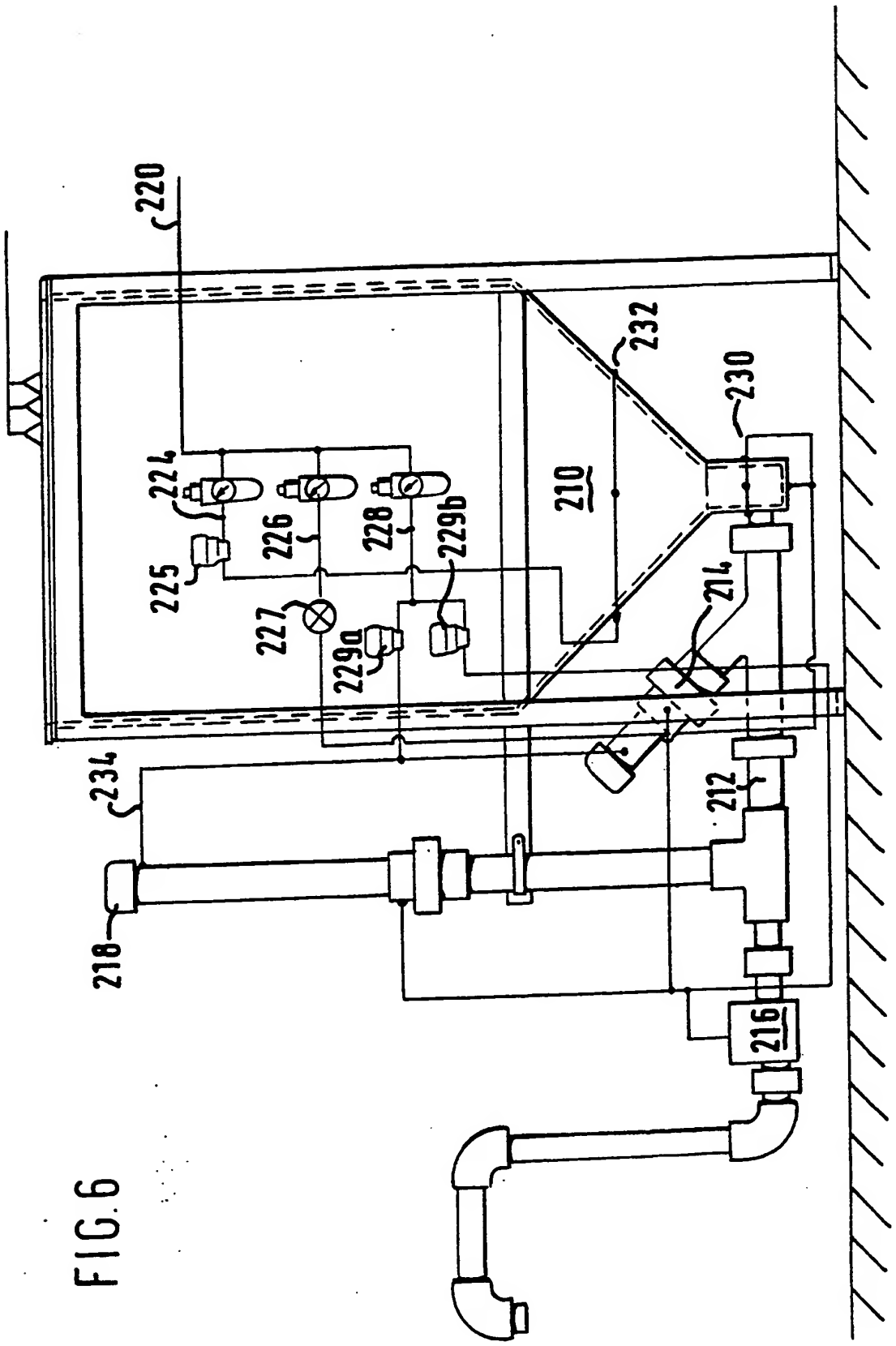


FIG.5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229b
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229a
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FIG.6

METHOD AND APPARATUS FOR FEEDING LIVESTOCK

The present invention relates to a method and apparatus for feeding livestock and, in particular, relates to a method and apparatus of feeding livestock according to their individual weight. The invention is particularly concerned with the feeding of pigs, although any type of livestock may be fed in the manner described.

Livestock and, in particular, pigs are often fed in groups of 15 or 20 animals. Food is supplied to a pen which may contain 15 to 20 animals, in an amount according to the average weight of the animals contained in the pen and in an amount required to ensure that the average weight of the animals increases as a result of feeding. One of the problems with such a system is that certain animals may take more food than they require and put on more weight than is desired, whereas other animals amongst the group of 15 to 20 may take less food than is desired to enable to individual animal to put on sufficient weight.

The present invention attempts to overcome this problem by providing a method and apparatus that allows the individual pig to be weighed and be provided with sufficient food required by that individual to enable it to increase its weight.

According to the present invention there is provided a first holding area for the animals prior to feeding, a simultaneous weighing and feeding means, the feeding means being capable of dispensing food according to the weight of the animal, and a second holding area for the animal following feeding.

The present invention also provides a dispensing apparatus for a fluidic material such as powders or solid liquid suspensions. The dispensing apparatus comprises a holding vessel for the fluidic material, a pump for

withdrawing fluid material in a known volume, a means for preventing further material from being withdrawn and a means for dispensing the material.

One embodiment of the present invention includes a first holding area, an enclosure which includes an entrance, a weighing means, a feed dispensing means, and an exit into the second pen or holding area.

In a particularly preferred embodiment, the combined weighing and feeding means is arranged in the form of a carousel capable of carrying more than one animal, the carousel having an entrance, a means for weighing animals on the carousel, means for dispensing feed according to the animal's weight, a rotary means to rotate the animals during feeding such that they have sufficient time to feed before they reach an exit where they alight from the carousel. The carousel may be capable of carrying any number of animals but preferably will carry up to 12 at one time. By this means, a number of animals may be fed at the same time. Optionally, a second exit, preferably between the first two gates, can be incorporated to remove certain animals once they have reached their optimum weight.

In one embodiment, the weighing means comprises a load cell capable of weighing one or more animals at the same time. In particular the load cell can be applied to the carousel, such that the total weight of the animals on the carousel can be observed and recorded. Computer control can be incorporated into such a system, such that the difference in weight between one animal entering the carousel and leaving the carousel can be determined so that each individual animal upon the carousel can be determined. By this means an individual animal may have dispensed to it a particular amount of food according to the weight of the animal.

The entrances and exits may be in the form of gates, if required. The entrance and exit gates as well as the optional third gate may be the same as one another or be different. The gates can be vertically sliding gates or rotary gates capable of rotating about a horizontal axis. Alternatively, the gates may be electric bars to prevent the exit of the animal from the feeding station.

The present invention will be further described by further example only, with reference to the accompanying drawings, in which:-

Figure 1 shows a plan view of the apparatus of the present invention;

Figure 2 shows a cross-section along the line X-X of Figure 1;

Figure 3 shows a plan view of a further embodiment of the present invention;

Figure 4 shows a cross-section along the line 4-4 of Figure 3;

Figure 5 shows a cross-section along the line 5-5 of Figure 4; and

Figure 6 shows a diagrammatic view of the dispensing apparatus of this invention.

Referring now to the figures, a general animal feeding area 20 has a first animal holding area 22, a second animal holding area 24 and a third animal holding area 26 for removing animals, for example when they have reached their required weight etc. A carousel 28 has 12 stations numbered from 1 to 12 which extend from a central portion to a side wall 30 each being divided by radial side walls 31. At station 1, the side wall 30 is interrupted and has incorporated therein a rotary gate 32. The rotary gate is maintained in position by an electronic solenoid lock 34. The rotary gate 32 has four quadrants 36, 38, 40 and 42. Side wall 30 is similarly interrupted at station 12 by a

second rotary gate 44 which is exactly similar to rotary gate 32. A third rotary gate 46 may be positioned at, for example, station 7 to allow access to the third holding pen 26 as desired. The rotary carousel 28 is mounted on a central bearing and drive wheel assembly 48 which incorporates a load cell unit 50. The load cell unit 50 enables the total weight of the rotary carousel 28 to be observed as required and this clearly can include any animals contained on the rotary carousel. Suspended from the carousel are slatted floors 52 and feed troughs 54 which are individual to each station within the carousel. At station 1 only a feed input and control valve 56 is positioned such that it can supply feedstuff to the trough which is positioned in station 1. A motor and gearbox unit 58 drives the rotary carousel, together with individual stations, including the radial side walls 31, the slatted floor 52 and the feed troughs 54, but not including the fixed side wall 30 or the feed input and control valve 56 which only supplies station 1.

In operation, animals are retained in holding area 1 and enter individually through rotary gate 32 which is unlocked to allow the animal to gain access to station 1 by rotating the gate one quarter of a turn. The animal is now positioned at station 1 and separated from the remaining stations by the radial side walls 31. The animal is retained on the carousel which is in effect a large weighing machine and, accordingly, the weight of the animal can be determined. Feedstuff is dispensed through the feed input control valve 56 in an amount suitable for the weight of the animal at station 1. On completion of the supply of feedstuff through the feed input control valve 56, the total weight of the pig and the amount of feed dispensed can be measured. The carousel is rotated in a clockwise direction so that the station 12 arrives at position 1 and the animal is

now retained at station 2. A second animal is allowed to enter station 1 by the rotary gate 32 which rotates one quarter of a turn and then is locked to retain the animal at station 1. Once again the animal is weighed, the weight of the animal being the difference between the weight of the carousel plus the first animal and its feedstuff. Further feedstuff is dispensed by the feed input control valve 56 in sufficient quantity according to the weight of the animal now at station 1. The carousel is rotated such that the first animal reaches station 3, the second animal reaches station 2 and the station 1 is empty. The gate 32 is unlocked by means of electric solenoid lock 34 and a further animal is allowed to enter the station by rotating the gate one quarter of a turn and subsequently locking it. Once again the animal is weighed and feedstuff is dispensed by feed input control valve 56, according to the weight of the animal determined by the difference between the total weight of the carousel including the first two animals and the weight of the newly arrived animal at station 1.

This process is completed until the first animal reaches the station 12, by which time it should have eaten all the feed in the feed trough 54. Rotary gate 44 is unlocked and the animal is urged to move backwards out of station 12 leaving it vacant. On further rotation of the carousel 28, station 12 moves to position 1 to allow a further animal to enter the carousel as previously described.

Eventually, all the animals retained in holding area 22 pass through the carousel, are weighed, are fed and will exit from station 12 into holding area 24.

When the animals are required to be fed again, the reverse process takes place. The first animal is encouraged to enter via rotary gate 44 to station 12 where it is weighed, feed is dispensed to the trough 54 via the

feed input and control valve 56, dispensed in an amount according to the weight of the animal. On completion, the carousel rotates in an anticlockwise direction such that the animal moves to station 11 and a second animal is allowed to enter at station 12, is weighed, is fed, the carousel subsequently rotated such that the first animal reaches station 10, the second animal reaches station 11. A third animal is again allowed to enter at station 12. The whole feeding process is repeated with the carousel moving in an anticlockwise direction.

By connecting the weight measurement to a computer control system, it is possible for individual animals to be weighed and fed according to their weight. The growth weight being monitored during the feed process. It is desirable to feed the animals in the above-described manner, approximately four times a day with sufficient food to enable the animal to gain weight. The animal can be expected to eat all the food placed in the trough 54 at each feed time.

An optional feature of the present invention is a holding pen 26 reached from the carousel via a rotary gate 46. As previously indicated, rotary gates 32, 44 and 46 are substantially similar. By judicious programming of the control computer, it is possible to remove any animals which have reached a preset weight, such that the carousel will stop at station 7. The electric solenoid lock 34 will unlock the gate 46, rotate and cause the animal to back into the holding pen 26. By operating gates 42, 44 and 46 in sequence, by means of the electronic solenoid lock controlled by the computer, it is possible to ensure that the weight of individual animals is properly monitored by difference from the total weight of the carousel and the animals in the stations on the carousel.

Other embodiments of the present invention are

envisaged whereby the rotary carousel 28 is replaced by an elongated system of feeding stations as shown in Figures 3, 4 and 5. Twelve feeding stations are arranged longitudinally between two animal holding areas 122 and 124. Each of the feeding stations has a gate each side of the feeding station generally designated 126 and 128. These gates may slide upwardly as required. Incorporated in each gate is a feeding trough 130 and 132 supplied from a central supply unit 134. Each feeding trough 130 and 132 has a branch 136 and 136 extending from the central supply unit and incorporating an electrically operated valve 140 and 142. It is therefore possible to supply each individual trough from the central supply unit by operating the valves according to the branch which supplies that trough.

A central support means 144, as shown in Figure 5, supports the feeding stations on a load cell unit 146 which can determine the weight of the feeding stations including animals contained therein. Each feeding station has a slatted floor 147.

In operation an animal is allowed to enter, for example, station 1, passing from holding unit 122 by the upper side of the gate 130. Once into the feeding station 1, the gate is closed, the animal is weighed by means of a load cell and food is dispensed into the trough 132 via pipe 138. A similar action occurs with respect to feeding station 2. The gate 126 is opened, the animal is allowed to enter, the gate 126 is closed, the animal is weighed by means of a load cell 146 and food is dispensed into the trough 132 according to the weight of the animal.

Similarly, animals are allowed to enter feeding stations 3 to 12, each animal being duly weighed and fed according to its weight. As soon as the animal in feeding station 1 has been fed, the gate 128 is opened and the

animal is allowed to pass into holding area 124, the gate 128 is closed, gate 126 is opened and a further animal is allowed to enter feeding station 1 as previously described. Eventually all animals pass from holding area 122 to holding area 124, all having been weighed and fed. At the next feeding time the reverse feeding process takes place, the animals entering feeding station 1 from the holding pen 124 by opening the gate 128, closing it, weighing the animal by means of the load cell 146, feeding the animal by supplying the trough 130 with sufficient food according to the weight of the animal and repeating the process with the remaining feeding stations 2 to 12. The process is further repeated by opening the gate 126 when the animal in feeding station 1 has finished allowing it to pass into holding pen 122, closing the gate 126, opening the gate 128 to allow a further animal into feeding station 1 and repeating the process until all animals held in holding pen 124 have through the feeding stations to holding pen 122.

When an individual animal reaches a predetermined weight, it can be retained in a feeding station until a stockman can remove that animal individually, as desired.

One of the problems of feeding any livestock is providing a sufficient amount of feedstuff to enable the animal to gain weight without providing the food in excessive amounts or in an amount which the animal will not eat.

In an alternative embodiment of the invention, the carousel is suspended from above by three tension rods or chains, indicated in chain lines at 51 in Figure 2, each of which incorporates a load cell 53. The weight of the carousel and the animals present in the stations can thus be weighed and signals from the load cells used to control the amount of food dispensed into the feed troughs.

In a further alternative arrangement, the carousel is supported on three points at floor level, each of those points having a load all such that the weight of the unit and its load can be determined.

In order to prevent the carousel from rotating before an animal is positioned fully in the entry station 1 a suitable sensor may be provided which emits a signal to actuate an interlock arrangement to maintain the carousel in a stationary condition. Similarly a sensor is provided to ensure that an animal has left station 12 before rotation of the carousel is possible.

With the same regard to the safety of the animals, the arrangement is such that the solenoid lock 34 on the gate is maintained in operative position so long as the carousel is being rotated. An additional arrangement may

be provided whereby the carousel may not be rotated when the solenoid lock is operative.

As described earlier, when an animal is found to have reached a predetermined weight, it is caused to leave the carousel at station 7. When that animal enters the carousel at station 1, its weight is computed and if it has reached the predetermined weight, and the system is programmed so as to actuate the gate 46 to cause that animal to leave at station 7.

Alternatively, a separate load cell may be positioned beneath the floor at station 7 to actuate the gate 46 if it records the predetermined weight.

A dispensing apparatus can be used in conjunction with the feeding apparatus described above. The dispensing apparatus will be further described with reference to Figure 6. Often foodstuff is in a liquid form, or in a liquid suspension or dispersion, for example, ground meal mixed with water, whey, etc., the meal and whey require to be mixed with the water in specific amounts. Often after mixing, the solids can disperse from the liquid such that

some animals receive more solids than liquids, whereas the remaining animals will receive more liquids than solids. A tank 20 which can be of any shape but as described is a cylindrical tank having a frustoconical base which extends into an outlet line 212 which passes to feed troughs (not shown). The tank 210 has an air mixer at its base and an upper air mixer towards the top of the frustoconical portion.

The outlet line 212 is closed by means of a first valve 214 which, as shown, may be an air activated angled seat valve. The outlet line is separated from the first valve 214 from a second valve 216 which, as shown, may be an air activated diaphragm valve. Between the two valves is a piston pump 218 which dispenses metered amounts of feed from the tank by means of a known volume distance stroke. A main air line 220 supplies three further air lines 224, 226 and 228. Air line 226 provides air to the lower air mixer 230. Air line 224 provides air to the upper air mixer 232. Air line 228 provides air to operate the diaphragm valve 216, the air activated angled seat valve 214 and the piston pump 218. A further air line 234 extends from the upper portion of the piston pump 218 to the upper portion of the air activated valve 214.

In operation, feedstuff, both liquid and solid, is placed in the tank 210 and is mixed by opening valve 227 in air line 226 to allow air to pass to the lower air mixer 230 and operating the solenoid 225 and allowing air to pass along air line 224 to the upper air mixer 232. Once the feed is mixed the soldnoid 225 closes the air line 224, leaving only the lower air mixer 230 in operation to keep the liquid feed in suspension.

When the piston in the piston pump 218 is in the down position, air line 234 is pressurised by opening solenoid valve 229a allowing air to pass along air line 228 to the

top of the piston pump 218. Solenoid valve 229 is operated which causes the piston in the piston pump to raise exhausting air through solenoid valve 229a. At the same time the valve 216 is closed and valve 214 is open, allowing mixed feedstuff to be drawn into the piston pump 218 as it rises. As it reaches its uppermost position, solenoid valves 229a and 229b are de-energised.

When piston pump 218 reaches its upper position, solenoid valves 229a and 229b are de-energised allowing air to escape from air line 228 causing the valve 214 to close and valve 216 to open. Air is passed through air line 234 causing the piston to travel downwards forcing the liquid feed through the valve 216 to the trough as required. The cycle can be repeated as many times as is necessary to dispense the desired amount of liquid feed.

Whilst the dispenser has been described with reference particularly to liquid feeds, it can also be used with other suspensions, i.e. solids in liquids, other than water, as well as with other dry products. Dry products may include cement and various other powders.

CLAIMS

1. An animal feeding apparatus comprising the first holding area for the animals prior to feeding, a simultaneous weighing and feeding means, the feeding means being capable of dispensing feed according to the weight of the animal, and a second holding area for the animal following feeding.

2. An apparatus as claimed in claim 1 wherein the simultaneous weighing and feeding means comprises a carousel capable of carrying more than one animal, the carousel having an entrance, a means for weighing the animals on the carousel, means for dispensing feed according to the animal's weight, a rotary means to rotate the animals during feeding such that they have sufficient time to feed before they reach an exit where they may alight from the carousel.

3. An apparatus as claimed in claim 2 wherein the carousel includes a second exit preferably between the entance and the first exit such that animals can be removed when they have reached an optimum size.

4. An apparatus as claimed in any one of the preceding claims wherein the weighing means comprises a load cell capable of weighing one or more animals at the same time.

5. An apparatus as claimed in claim 4 wherein the load cell is capable of weighing the total number of animals in the apparatus and following the admission of a single animal capable of determining the weight of the animal by the difference between the weights when the additional animal enters the apparatus.

6. An apparatus as claimed in claim 2 wherein the entrances and exits are in the form of gates.

7. An apparatus as claimed in claim 2 wherein the entrance and exit gates are of the same type as one another.

8. An apparatus as claimed in claims 6 and 7 wherein the gates are vertically sliding gates.

9. An apparatus as claimed in claims 6 and 7 wherein the gate is a rotary gate having horizontal axis.

10. An apparatus as claimed in claims 6 and 7 wherein the gates are electric bars to prevent the exit of the animals from the feeding station.

11. A dispensing apparatus for fluid material, the dispensing apparatus comprising a holding vessel for the fluid material, a pump for withdrawing fluid material in a known volume, a means for preventing further material from being withdrawn and a means for dispensing the material.

12. An apparatus as claimed in claim 11 wherein the pump for withdrawing the fluid material in a known volume is a piston pump having a stroke of known volume.

13. An apparatus as claimed in claim 1 substantially as hereinbefore described with reference to the accompanying drawings.

14. Apparatus as claimed in claim 11 substantially as hereinbefore described with reference to the accompanying drawings.

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